METHOD AND DEVICE FOR THE MECHANICAL TREATMENT OF A YARN, PARTICULARLY A SYNTHETIC MULTI-STRAND YARN, AND YARN PRODUCED IN THIS WAY

DESCRIPTION

Technical Field

The present invention relates to a method for treating a yarn in order to obtain particular characteristics of softness and "hand", and to a device for the application of this method.

The invention also relates to a yarn processed by said method.

State of the Art

A yarn known as "Taslan" is frequently used in the production of textile articles for clothing, particularly for sports clothing, and for other applications, for example for making upholstery fabrics. This yarn is produced from synthetic yarns of the continuous strand type, in other words yarns consisting of continuous filaments. Taslan is produced by a process which is called air-texturing. In this process, one or more yarns, each consisting of continuous strands or filaments, are inserted into a nozzle where they are struck by a jet of compressed air. The turbulence caused by this jet leads to the formation of loops, curls and swellings in the individual strands or filaments, which remain trapped in the fibrous structure. Thus a bulky and essentially inelastic yarn is produced.

Usually, at least two yarns are fed into the texturing nozzle, one being intended to form what is known as the core of the yarn and the other being intended to form a surface effect. These are referred to as the core yarn and the effect yarn. The core yarn forms the anchorage for the loops or curls formed by the strands, in other words by the continuous filaments of the effect yarn.

Methods and devices for the execution of this type of process are described in U.S. patents 4,041,583, 4,492,009, 4,507,833, 5,054,174, 5,140,729, 5,142,754, 5,241,730, 5,713,113, 6,088,892, 6,148,490 and 6,354,069.

These yarns have a number of advantages, including high tenacity and

low cost. However, in the production of articles of clothing they are limited by their synthetic nature and the consequent absence of the softness typical of natural yarns such as cotton. The articles produced with this yarn are therefore not always pleasing to the final consumer.

Objects and Summary of the Invention

The object of the present invention is to provide a method for producing a yarn with better tactile characteristics, particularly from air-textured yarns and especially in order to produce articles of clothing.

Essentially, these effects are produced, according to the invention, by a treatment of the textile yarn characterized in that said yarn is subjected to mechanical surface processing, particularly abrasive processing, using a fixed or moving grinder.

The term "mechanical processing" denotes processing which is capable of breaking the fibers or filaments forming the yarn. Abrasive processing, in particular, has the advantage of causing not only the breaking of the fibers or filaments, but also the extraction of the broken strands or fibers from the body of the yarn. This increases the softness of the yarn and improves the hand of the fabric.

In one particular embodiment, a motorized grinder with a conical surface is used for this purpose.

In one particular embodiment, the method according to the invention comprises the following steps:

- forming a synthetic yarn comprising a plurality of continuous strands or filaments;
- subjecting said yarn to said mechanical surface processing to break at least one of said continuous strands or filaments and to form a plurality of discontinuous fibers projecting from the yarn.

Advantageously and preferably, the treated yarn is an air-textured yarn, produced by a "Taslan" or similar process, consisting of at least one synthetic thread formed from continuous strands or filaments.

In a particularly advantageous embodiment of the invention, the process comprises:

- forming a composite synthetic yarn comprising: (a) a multi-strand thread with continuous strands or filaments forming a core; and (b) a multi-strand effect thread with continuous strands or filaments, joined by air texturing to said core;
- subjecting said composite synthetic yarn to said mechanical surface processing which interrupts the continuity of at least some of the continuous strands or filaments forming the effect thread.

To stabilize the yarn, and to counteract its tendency to contract or reduce in length after processing, in an improved embodiment of the invention the yarn is subjected to stretching and the mechanical surface processing is carried out in an area of the yarn subjected to stretching. It has been found that, when this is done, the treated yarn does not tend to contract, particularly when subjected to dyeing or other wet treatment. The stretch can be of the order of 4-5%, or more generally of the order of 3-6%, understood as the percentage elongation of the yarn with respect to the original length. However, it should be understood that degrees of stretching other than those indicated above can be used.

The process according to the invention makes it possible to produce, from an air-textured synthetic yarn, a yarn having tactile characteristics very similar to those of a natural cotton yarn. This is because the continuous strands or filaments which are broken by the mechanical abrasive or equivalent processing form free ends which project from the yarn, creating an effect similar to that of the short fibers typical of natural yarns.

The result is a product having a low cost, equivalent to the cost of synthetic yarn, but with tactile and "hand" characteristics typical of cotton. The yarn produced also has the advantages of synthetic yarn in terms of mechanical strength and tenacity, which are useful during spinning, since they reduce the frequency of yarn breakage and consequent downtime.

Additionally, the release of the fibers and nap of the yarn produced according to the invention is less than that found in natural yarn, since the cut strands remain trapped in the body of the yarn, with consequent advantages in the production of the finished articles.

The yarn produced also has advantages in terms of dyeing, since it can be dyed at lower temperatures (typically 80°C) than the temperatures at which cotton fiber yarn has to be dyed (typically 120°C). This provides an economic advantage due to the lower energy consumption for dyeing.

In a different aspect, the invention relates to a device for producing a yarn, including a path for the yarn, characterized by at least one element for mechanical surface processing, typically by abrasion, of the yarn, arranged along said path and carrying out mechanical surface processing on said yarn.

In a particularly advantageous embodiment of the invention, the device also comprises stretching elements, which force the yarn to undergo stretching in the area subject to the mechanical treatment. The mechanical processing element acts on the yarn under tension, in such a way that after the abrasion processing the tendency of the yarn to contract, during dyeing for example, is reduced.

In a particularly advantageous embodiment of the invention, the device comprises an air-texturing system located upstream of the mechanical processing element. In this case, the treated yarn is an air-textured yarn, such as what is known as a "Taslan" yarn.

Further advantageous characteristics and embodiments of the device and method according to the invention are indicated in the attached claims and will be described in greater detail with reference to an example of embodiment.

In a further aspect, the invention also relates to a textile yarn comprising fibers formed by the breakage of longer filaments by mechanical processing. Advantageously, the yarn consists at least partially (and preferably entirely) of synthetic filaments. In a practical embodiment, the yarn can be an air-textured yarn, with a plurality of continuous synthetic strands or filaments and with a plurality of discontinuous fibers, formed by the breaking of at least some of said continuous filaments by mechanical processing.

Brief Description of the Drawings

The invention will be more clearly understood from the description and the attached drawing, which shows a practical and non-restrictive

embodiment of the invention. More particularly, in the drawing,

Fig. 1 is a schematic side view of the whole of a device according to the invention;

Fig. 2 is an enlarged detail of Fig. 1;

Fig. 3 is a view taken through III-III in Fig. 2;

Fig. 4 is a macrophotograph of three lengths of yarn, of which one is treated according to the invention, one is cotton, and one is Taslan; and

Fig. 5 is a macrophotograph of two lengths of yarn, of which one is a yarn treated according to the invention and one is cotton yarn.

Detailed Description of the Preferred Embodiment of the Invention

Fig. 1 shows a schematic side view of a device incorporating the invention. The device comprises a feed path for two yarns, indicated by F1 and F2 respectively, taken from packages or reels positioned on a creel which is not shown. The yarn F1 is fed around a first pair of rollers of different diameters, indicated by 3A and 5A, and around a second pair of rollers of different diameters, indicated by 3B and 5B. The peripheral speed of the rollers can be controlled to impart an appropriate stretch to the yarn F1, according to the type of end product to be obtained.

The yarn F2 follows a path around two pairs of rollers with different diameters, indicated by 7A, 9A and 7B, 9B and essentially identical to the rollers 3A, 5A, 3B and 5B.

In a known way, the rollers 3A, 3B, 7A and 7B are motorized rollers, while the rollers 5A, 5B, 9A and 9B are idle rollers which are used to guide the yarn in the correct way.

The two yarns F1 and F2 are both synthetic yarns consisting of parallel continuous filaments or strands. They may, for example, be POY, PES, PP, viscose or other yarns, with fine or very fine filaments. The yarn F1 is intended to form the core of the textured yarn, while the yarn F2 is the effect yarn, in other words the yarn intended to form the outer part of the textured yarn, forming with its strands or filaments the curls or loops which increase the volume of the finished yarn. It is also possible to feed more than two yarns, with a variable number of core yarns and effect yarns. In practice, the core

yarn is fed at a certain velocity, while the effect yarn is overfed, in such a way as to make a sufficient quantity of effect yarn available in the texturing nozzle.

The two yarns F1 and F2, subjected to a suitable stretch ratio which can be selected as desired and independently for the two yarns according to principles known to those skilled in the art, are fed to a compressed-air texturing or bulking nozzle, indicated as a whole by 11.

The texturing nozzle 11 can consist, for example, of a HamaJet® LB nozzle or a HamaJet® EO-52 nozzle, both made by the Heberlein company (Germany), or another nozzle for the same type of application, for example one made according to one or more of the patents mentioned in the introduction.

The device described up to this point is of a known type and the processing which it carries out is thus also known.

The yarn F leaving the texturing jet or nozzle 11 is a high-volume air-textured yarn. It is run around a first pair of rollers 13A, 15A of different diameters, having a configuration equivalent to that of the rollers 3A, 5A or 7A, 9A, in which the roller 13A of greater diameter is motorized. The yarn F forms a set of turns around this pair of rollers. A second pair of rollers 13B, 15B of different diameters, essentially identical to the rollers 13A, 15A, is placed along the path of the yarn F, the roller 13B being motorized, while the roller 15B (like the roller 15A) is idle and is used to guide the yarn correctly. The yarn F also forms a set of turns around this second pair of rollers 13B, 15B, and then continues from here along its path towards a winding system, of a known type, which winds the yarn onto winding tubes to form packages or reels B.

As shown in Figs. 2 and 3 in particular, a belt 21 receives its motion from a pulley 23 coaxial with the roller 13A and integral therewith, and transmits its motion to a pulley 25 coaxial with the roller 13B. The roller 13A is motorized and its rotary motion is thus transmitted by means of the pulley 21 to the roller 13B. By a suitable choice of diameters of the pulleys 23 and 25 (which are suitably toothed, as is the belt 21), it is possible to impart different peripheral velocities to the two rollers 13A and 13B, so that the yarn F is

subjected to a stretch, of approximately 3-6% for example.

The path of the belt 21 is additionally determined by a tensioning device 27 so that said belt also imparts motion to a pulley 28 keyed on the axis of rotation A-A of a grinder 29 of conical shape. The axis of rotation A-A of the grinder is parallel to the axes of rotation of the rollers 13A and 13B. The shaft of the grinder 29, the pulley 28 and the corresponding supports are carried by an oscillating arm 30 pivoted about an axis coincident with the axis of the roller 13B. The oscillatory movement of the arm 30 is controlled manually or by means of an actuator which is not shown. Thus the grinder can assume a working position shown in solid lines in Fig. 2 and a position for insertion of the yarn F, shown in broken lines in said figure, which is elevated with respect to the working position.

The conical grinder 29 is positioned along the portion of the path of the yarn F extending between the two rollers 13A and 13B, in other words along the portion in which this yarn is put under tension by the stretch imparted by the difference in peripheral velocities between the two rollers 13A and 13B. Two yarn guides 31 and 33 are also placed in this portion, upstream and downstream of the grinder with respect to the direction of advance of the yarn F.

As can be seen in Fig. 3 in particular, these yarn guides have grooves for guiding the yarn F which are slightly staggered with respect to each other, in such a way that the yarn F guided by the two yarn guides and running around the grinder 29 contacts the grinder along a line which is inclined with respect to the axis of rotation A-A of the grinder. This arrangement provides a self-cleaning action for the grinder, to prevent it from becoming blunt and to prevent the accumulation of yarn residues on it. The self-cleaning action can also be obtained by using a suitable shape of grinder, for example a conical shape, without the staggered arrangement of the yarn guides. Alternatively, the staggered guides can be used in combination with a cylindrical grinder, to obtain the self-cleaning action as a result of the inclined position of the line of contact between the grinder and the yarn.

The grinder 29, together with the yarn guides 31 and 33 and the rollers

13B and 15B, is enclosed in a chamber 37, provided with an aperture for the passage of the yarn F, the interior of this chamber being maintained at a slightly negative pressure by a suction line 39 connected to a suction system. This enables the residues of textile fiber generated by the abrasive action of the grinder 29 on the yarn F to be collected and removed.

The device described up to this point operates in the following way. The core and effect yarns F1 and F2 are fed, with suitable stretching, to the air-texturing nozzle 11, and the resulting yarn F is run around the roller 13A. The velocities of the rollers 3A, 3B, 7A and 7B are controlled in accordance with the velocity of the roller 13A, to provide the most suitable ratios of velocity according to the characteristics of the textured yarn which is to be produced. This adjustment can be carried out on the basis of what is already known in the production of air-textured yarns of known types.

The resulting yarn F has curls or loops anchored to the core yarn and formed by the turbulence of the compressed air in the texturing nozzle 11. Since the strands or filaments forming the yarn F are continuous, the loops or curls are also continuous; in other words, each strand or filament emerging from the principal body of the yarn re-enters it without interruption.

The yarn F leaving the nozzle 11 is run around the rollers 13A and 13B and is subjected to stretching by a percentage preferably of 3% to 6% and more preferably by 4% to 5%. In the area subjected to stretching, the yarn F is subjected to mechanical processing by the grinder 29. The abrasive action of the grinder causes the incidental breaking of some of the continuous strands or yarns which emerge from the filament in the form of curls or loops, and which in practice generate shorter fibers whose ends project in an entirely random way from the yarn. The yarn is thus given a tactile characteristic similar to that of a natural cotton yarn, in other words one formed by the combination of discontinuous fibers.

It will be understood that the mechanical processing of the yarn can also be carried out by tools of different types. In particular, it is possible to provide for the use of more than one grinder, placed around the axis of the yarn, although it has been found that a single grinder provides a sufficient

abrasion action around the yarn. It is also possible to use a fixed abrasive element, on which the yarn is rubbed as a result of its feed movement.

Fig. 4 shows for comparison three portions of yarn, namely:

- a yarn according to the invention (thread A);
- a cotton yarn (thread B);
- a Taslan yarn (thread C).

In practice, the Taslan yarn has continuous strands or filaments which form curls or loops which re-enter the yarn. Conversely, in the yarn treated mechanically by the grinder 29 it is possible to note the presence of interrupted fibers whose free ends project from the main body of the yarn, forming a structure very similar to that of natural cotton (yarn B). Fig. 5 shows for comparison a portion of yarn according to the invention (thread A) and a portion of natural cotton yarn (thread B), in which the similarity of the structures of the two yarns is seen even more clearly, although the first yarn is produced from a continuous multi-strand yarn.

It is to be understood that the drawing shows only a practical embodiment of the invention, which can be varied in its forms and arrangements without departure from the scope of the guiding principle of the invention.